CLAIMS

What is claimed is:

1. A composition of matter that is adapted for use in a solar cell, said composition of matter comprising a mixture of a semi-conducting polymer and an ionic electrolyte wherein said semi-conducting polymer comprises a p-type polymer and an n-type electron acceptor and said ionic electrolyte is present in said mixture in an amount ranging from 0.01 to 5 weight percent.

2. A composition of matter according to claim **1** wherein said semi-conducting polymer is selected from the group consisting of poly(p-phenylene-vinylene) derivatives, polyfluorene derivatives and polythiophene derivatives.

3. A composition of matter according to claim **2** wherein said poly(p-phenylene-vinylene derivative is selected from the group consisting of poly(2-methoxy-5-(2'-ethyl-hexyloxy)-1,4-phenylene vinylene), poly(2-butoxy, 5-2'-ethyl-hexyloxy-p-phenylene vinylene) and poly(2,5-bis~cheolestranoxy-1,4-phenylene vinylene).

4. A composition of matter according to claim **2** wherein said polyflouorene derivative is selected from the group consisting of poly(9,9-dioctylfluorene), poly(9,9'-dioctylfluorene-*co*-benzothiadiazole), and poly(9,9'-dioctylfluorene-*co*-bis-*N,N'*-(4-butylphenyl)-bis-*N,N'*-phenyl-1,4-phenylenediamine).

5. A composition of matter according to claim **2** wherein said polythiophene derivative is selected from the group consisting of poly(3-alkylthiophene), poly(3-(4-octyl-phenyl)-2,2-bithiophene and poly(3-(4'-(1",4",7"-trioxaoctyl)thiophene).

6. A composition of matter according to claim **3** wherein said poly(p-phenylene-vinylene derivative is poly(2-methoxy-5-(2'-ethyl-hexyloxy)-1,4-phenylene vinylene).

7. A composition of matter according to claim **1** wherein said n-type electron acceptor is selected from the group consisting of C_{60}, cyano-poly(p-phenylene-vinylene) and carbon nano tubes.

8. A composition of matter according to claim **7** wherein said n-type electron acceptor is C_{60}.

9. A composition of matter according to claim **6** wherein said n-type electron acceptor is C_{60}.

10. A composition of matter according to claim **1** wherein said ionic electrolyte is selected from the group consisting of $LiCF_3SO_3$, $LiPF_6$, $LiAsF_6$, $LiSbF_6$, lithium perchlorate, lithium triflate and lithium trifluoromethyl sulfonimide.

11. A composition of matter according to claim **10** wherein said ionic electrolyte is $LiCF_3SO_3$.

12. A composition of matter according to claim **9** wherein said ionic electrolyte is $LiCF_3SO_3$.

13. A composition of matter according to claim **1** wherein the amount of said ionic electrolyte present in said mixture ranges from 0.2 to 2.5 percent by weight.

14. A composition of matter according to claim **1** wherein said ionic electrolyte is a polymeric ionic electrolyte that comprises said ionic electrolyte in combination with a polymer selected from the group consisting of polyethylene oxide and crown ether-containing compounds.

15. A composition of matter according to claim **14** wherein said polymeric ionic electrolyte comprises said ionic electrolyte in combination with polyethylene oxide.

16. A composition of matter according to claim **15** wherein said p-type polymer is poly(2-methoxy-5-(2'-ethyl-hexyloxy)-1,4-phenylene vinylene), said n-type electron acceptor is C_{60} and said ionic electrolyte is $LiCF_3SO_3$.

17. A composition of matter according to claim **16** wherein the amount of ionic electrolyte present in said mixture is between 0.2 and 2.5 weight percent.

18. A composition of matter according to claim **17** wherein the amount of ionic electrolyte present in said mixture is about 1 weight percent.

19. A solar cell for use in converting sunlight into electricity, said solar cell comprising:

a composition of matter according to claim **1** that is in the form of a photovoltaic film having a first side and a second side;

an anode located on the first side of said photovoltaic film; and

a cathode located on the second side of said photovoltaic film.

20. A solar cell according to claim **19** wherein said semi-conducting polymer is selected from the group consisting of poly(p-phenylene-vinylene) derivatives, polyfluorene derivatives and polythiophene derivatives.

21. A solar cell according to claim **20** wherein said poly(p-phenylene-vinylene derivative is selected from the group consisting of poly(2-methoxy-5-(2'-ethyl-hexyloxy)-1,4-phenylene vinylene), poly(2-butoxy, 5-2'-ethyl-hexyloxy-p-phenylene vinylene) and poly(2,5-bis~cheolestranoxy-1,4-phenylene vinylene).

22. A solar cell according to claim **20** wherein said polyflouorene derivative is selected from the group consisting of poly(9,9-dioctylfluorene), poly(9,9'-dioctylfluorene-*co*-benzothiadiazole), and poly(9,9'-dioctylfluorene-*co*-bis-*N,N'*-(4-butylphenyl)-bis-*N,N'*-phenyl-1,4-phenylenediamine).

23. A solar cell according to claim **20** wherein said polythiophene derivative is selected from the group consisting of poly(3-alkylthiophene), poly(3-(4-octyl-phenyl)-2,2-bithiophene), and poly(3-(4'-(1",4",7"-trioxaoctyl)thiophene).

24. A solar cell according to claim **21** wherein said poly(p-phenylene-vinylene derivative is poly(2-methoxy-5-(2'-ethyl-hexyloxy)-1,4-phenylene vinylene).

25. A solar cell according to claim **19** wherein said n-type electron acceptor is selected from the group consisting of C_{60}, cyano-poly(p-phenylene-vinylene) and carbon nano tubes.

26. A solar cell according to claim **25** wherein said n-type electron acceptor is C_{60}.

27. A solar cell according to claim **24** wherein said n-type electron acceptor is C_{60}.

28. A solar cell according to claim **19** wherein said ionic electrolyte is selected from the group consisting of $LiCF_3SO_3$, $LiPF_6$, $LiAsF_6$, $LiSbF_6$, lithium perchlorate, lithium triflate and lithium trifluoromethyl sulfonimide.

29. A solar cell according to claim **28** wherein said ionic electrolyte is $LiCF_3SO_3$.

30. A solar cell according to claim **27** wherein said ionic electrolyte is $LiCF_3SO_3$.

31. A solar cell according to claim **19** wherein the amount of said ionic electrolyte present in said mixture ranges from 0.2 to 2.5 percent by weight.

32. A solar cell according to claim **19** wherein said ionic electrolyte is a polymeric ionic electrolyte that comprises said ionic electrolyte in combination with a polymer selected from the group consisting of polyethylene oxide and crown ether-containing compounds.

33. A solar cell according to claim **32** wherein said polymeric ionic electrolyte comprises said ionic electrolyte in combination with polyethylene oxide.

34. A solar cell according to claim **33** wherein said p-type polymer is poly(2-methoxy-5-(2'-ethyl-hexyloxy)-1,4-phenylene vinylene), said n-type electron acceptor is C_{60} and said ionic electrolyte is $LiCF_3SO_3$.

35. A solar cell according to claim **34** wherein the amount of ionic electrolyte present in said mixture is between 0.2 and 2.5 weight percent.

36. A solar cell according to claim **35** wherein the amount of ionic electrolyte present in said mixture is about 1 weight percent.

37. A method for making a solar cell comprising the steps of:

providing a composition of matter according to claim **1** that is in the form of a photovoltaic film having a first side and a second side;

placing an anode on the first side of said photovoltaic film wherein said anode is in electrical contact with said photovoltaic film; and

placing a cathode on the second side of said photovoltaic film wherein said cathode is in electrical contact with said photovoltaic film.

38. A method for making a solar cell according to claim **37** wherein said semi-conducting polymer is selected from the group consisting of poly(p-phenylene-vinylene) derivatives, polyfluorene derivatives and polythiophene derivatives.

39. A method for making a solar cell according to claim **38** wherein said poly(p-phenylene-vinylene derivative is selected from the group consisting of poly(2-methoxy-5-(2'-ethyl-hexyloxy)-1,4-phenylene vinylene), poly(2-butoxy, 5-2'-ethyl-hexyloxy-p-phenylene vinylene) and poly(2,5-bis~cheolestranoxy-1,4-phenylene vinylene).

40. A method for making a solar cell according to claim **38** wherein said polyflouorene derivative is selected from the group consisting of poly(9,9-dioctylfluorene), poly(9,9'-dioctylfluorene-*co*-benzothiadiazole), and poly(9,9'-dioctylfluorene-*co*-bis-*N,N'*-(4-butylphenyl)-bis-*N,N'*-phenyl-1,4-phenylenediamine).

41. A method for making solar cell according to claim **38** wherein said polythiophene derivative is selected from the group consisting of poly(3-alkylthiophene), poly(3-(4-octyl-phenyl)-2,2-bithiophene), and poly(3-(4'-(1",4",7"-trioxaoctyl)thiophene).

42. A method for making a solar cell according to claim **39** wherein said poly(p-phenylene-vinylene derivative is poly(2-methoxy-5-(2'-ethyl-hexyloxy)-1,4-phenylene vinylene).

43. A method for making a solar cell according to claim **37** wherein said n-type electron acceptor is selected from the group consisting of C_{60}, cyano-poly(p-phenylene-vinylene) and carbon nano tubes.

44. A method for making a solar cell according to claim **43** wherein said n-type electron acceptor is C_{60}.

45. A method for making a solar cell according to claim **42** wherein said n-type electron acceptor is C_{60}.

46. A method for making a solar cell according to claim **37** wherein said ionic electrolyte is selected from the group consisting of $LiCF_3SO_3$, $LiPF_6$, $LiAsF_6$, $LiSbF_6$, lithium perchlorate, lithium triflate and lithium trifluoromethyl sulfonimide.

47. A method for making a solar cell according to claim **46** wherein said ionic electrolyte is $LiCF_3SO_3$.

48. A method for making a solar cell according to claim **45** wherein said ionic electrolyte is $LiCF_3SO_3$.

49. A method for making a solar cell according to claim **37** wherein the amount of said ionic electrolyte present in said mixture ranges from 0.2 to 2.5 percent by weight.

50. A method for making a solar cell according to claim **37** wherein said ionic electrolyte is a polymeric ionic electrolyte that comprises said ionic electrolyte in combination with a polymer selected from the group consisting of polyethylene oxide and crown ether-containing compounds.

51. A method for making a solar cell according to claim **50** wherein said ionic electrolyte comprises said ionic electrolyte in combination with polyethylene oxide.

52. A method for making a solar cell according to claim **51** wherein said p-type polymer is poly(2-methoxy-5-(2'-ethyl-hexyloxy)-1,4-phenylene vinylene), said n-type electron acceptor is C60 and said ionic electrolyte is $LiCF_3SO_3$.

53. A method for making a solar cell according to claim **52** wherein the amount of ionic electrolyte present in said mixture is between 0.2 and 2.5 weight percent.

54. A method for making a solar cell according to claim **53** wherein the amount of ionic electrolyte present in said mixture is about 1 weight percent.

55. A method for converting sunlight into electricity comprising the steps of:

providing a solar cell according to claim **37**;

exposing said solar cell to sufficient sunlight to generate an electrical potential between said anode and said cathode.

56. A method for converting sunlight into electricity according to claim **55** wherein said semi-conducting polymer is selected from the group consisting of poly(p-phenylene-vinylene) derivatives, polyfluorene derivatives and polythiophene derivatives.

57. A method for converting sunlight into electricity according to claim **56** wherein said poly(p-phenylene-vinylene derivative is selected from the group consisting of poly(2-methoxy-5-(2'-ethyl-hexyloxy)-1,4-phenylene vinylene), poly(2-butoxy, 5-2'-ethyl-hexyloxy-p-phenylene vinylene) and poly(2,5-bis~cheolestranoxy-1,4-phenylene vinylene).

58. A method for converting sunlight into electriicty according to claim **56** wherein said polyflouorene derivative is selected from the group consisting of poly(9,9-dioctylfluorene), poly(9,9'-dioctylfluorene-*co*-benzothiadiazole), and poly(9,9'-dioctylfluorene-*co*-bis-*N,N'*-(4-butylphenyl)-bis-*N,N'*-phenyl-1,4-phenylenediamine).

59. A method for converting sunlight into electricity according to claim **56** wherein said polythiophene derivative is selected from the group consisting of poly(3-alkylthiophene), poly(3-(4-octyl-phenyl)-2,2-bithiophene), and poly(3-(4'-(1",4",7"-trioxaoctyl)thiophene).

60. A method for converting sunlight into electricity according to claim 57 wherein said poly(p-phenylene-vinylene derivative is poly(2-methoxy-5-(2'-ethyl-hexyloxy)-1,4-phenylene vinylene).

61. A method for converting sunlight into electricity according to claim 55 wherein said n-type electron acceptor is selected from the group consisting of C_{60}, cyano-poly(p-phenylene-vinylene) and carbon nano tubes.

62. A method for converting sunlight into electricity according to claim 61 wherein said n-type electron acceptor is C_{60}.

63. A method for converting sunlight into electricity according to claim 60 wherein said n-type electron acceptor is C_{60}.

64. A method for converting sunlight into electricity according to claim 55 wherein said ionic electrolyte is selected from the group consisting of $LiCF_3SO_3$, $LiPF_6$, $LiAsF_6$, $LiSbF_6$, lithium perchlorate, lithium triflate and lithium trifluoromethyl sulfonimide.

65. A method for converting sunlight into electricity according to claim 64 wherein said ionic electrolyte is $LiCF_3SO_3$.

66. A method for converting sunlight into electricity according to claim 63 wherein said ionic electrolyte is $LiCF_3SO_3$.

67. A method for converting sunlight into electricity according to claim 55 wherein the amount of said ionic electrolyte present in said mixture ranges from 0.2 to 2.5 percent by weight.

68. A method for converting sunlight into electricity according to claim 55 wherein said ionic electrolyte is a polymeric ionic electrolyte that comprises said

ionic electrolyte in combination with a polymer selected from the group consisting of polyethylene oxide and crown ether-containing compounds.

69. A method for converting sunlight into electricity according to claim **68** wherein said polymeric ionic electrolyte comprises said ionic electrolyte in combination with polyethylene oxide.

70. A method for converting sunlight into electricity according to claim **69** wherein said p-type polymer is poly(2-methoxy-5-(2'-ethyl-hexyloxy)-1,4-phenylene vinylene), said n-type electron acceptor is C60 and said ionic electrolyte is $LiCF_3SO_3$.

71. A method for converting sunlight into electricity according to claim **70** wherein the amount of ionic electrolyte present in said mixture is between 0.2 and 2.5 weight percent.

72. A method for converting sunlight into electricity according to claim **54** wherein the amount of ionic electrolyte present in said mixture is about 1 weight percent.